Name: ____________________ Date: ____________

Polynomial Operations SOLUTIONS (version 23)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 - 3x^3 - 7x^2 - 5x + 2$$

$$q(x) = 4x^5 + 3x^4 + 6x^3 + 7x - 5$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$p(x) = (8)x^5 + (0)x^4 + (-3)x^3 + (-7)x^2 + (-5)x^1 + (2)x^0$$
$$q(x) = (4)x^5 + (3)x^4 + (6)x^3 + (0)x^2 + (7)x^1 + (-5)x^0$$
$$p(x) - q(x) = (4)x^5 + (-3)x^4 + (-9)x^3 + (-7)x^2 + (-12)x^1 + (7)x^0$$
$$p(x) - q(x) = 4x^5 - 3x^4 - 9x^3 - 7x^2 - 12x + 7$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -4x^2 + 8x + 7$$

$$b(x) = -6x + 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-4x^2$	$8x$	7
$-6x$	$24x^3$	$-48x^2$	$-42x$
2	$-8x^2$	$16x$	14

$$a(x) \cdot b(x) = 24x^3 - 48x^2 - 8x^2 - 42x + 16x + 14$$

Combine like terms.

$$a(x) \cdot b(x) = 24x^3 - 56x^2 - 26x + 14$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 3x^3 + 21x^2 + 14x - 26 \\ g(x) &= x + 6 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+6}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 3 & 21 & 14 & -26 \\ -6 & & -18 & -18 & 24 \\ \hline & 3 & 3 & -4 & -2 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 3x^2 + 3x - 4 + \frac{-2}{x+6}$$

In other words, $h(x) = 3x^2 + 3x - 4$ and the remainder is $R = -2$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 3x^3 + 21x^2 + 14x - 26$. Evaluate $f(-6)$.

You could do this the hard way.

$$\begin{aligned} f(-6) &= (3)\cdot(-6)^3 \ + \ (21)\cdot(-6)^2 \ + \ (14)\cdot(-6) \ + \ (-26) \\ &= (3)\cdot(-216) \ + \ (21)\cdot(36) \ + \ (14)\cdot(-6) \ + \ (-26) \\ &= (-648) \ + \ (756) \ + \ (-84) \ + \ (-26) \\ &= -2 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-6)$ equals the remainder when $f(x)$ is divided by $x + 6$. Thus, $f(-6) = -2$.